ISSN (print) 0093-4666 © 2012. Mycotaxon, Ltd. ISSN (online) 2154-8889

MYCOTAXON

http://dx.doi.org/10.5248/120.309

Volume 120, pp. 309–316 *April–June 2012*

Notes on *Xylophallus xylogenus* (*Phallaceae*, *Agaricomycetes*) based on Brazilian specimens

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Abstract — From morphological analysis of *Phallus pygmaeus* specimens collected in Brazil and reexamination of the holotype, we conclude that this species is a synonym of the previously described *Xylophallus xylogenus* and agree with the recently proposed synonymy. We describe new specimens of *X. xylogenus* from Northeastern Brazil and provide color photos and a key for the species of the small xylophilous members of *Phallus,* including *Xylophallus.*

Key words — gasteromycetes, herbarium revision, *Mutinus*, stinkhorns, tropical fungi

Introduction

Phallus pygmaeus was described from the tropical rainforest in Northeastern Brazil, growing on decaying wood (Baseia et al. 2003). The species is characterized by small basidiomata (≤ 15 mm high), a smooth receptacle with minute perforate apex, and lignicolous habitat. The remarkably small size of this phalloid is not exclusive to *P. pygmaeus*, as other small species are known from the tropics, e.g., *Phallus tenuis* (E. Fisch.) Kuntze, *P. minusculus* Kreisel & Calonge, and *P. drewesii* Desjardin & B.A. Perry (Calonge & Kreisel 2002, Calonge 2005, Desjardin & Perry 2009).

Xylophallus xylogenus is a taxon with a problematic generic position. Originally described as *Phallus xylogenus* from Cayenne (French Guiana), its author (Montagne 1855) placed the species in sect. *Mutinus,* while some years later Schechtendal (1861) classified it in *Phallus* sect. *Xylophallus* Schltdl. Fischer (1898-99), who first proposed the combination *Mutinus xylogenus,* later erected the genus *Xylophallus* (Schltdl.) E. Fisch. for the species (Fischer 1933a). Sáenz et al. (1972) also contributed to the morphology and ontogeny of the species based on collections from Costa Rica. Since its original description, *X. xylogenus* has been ambiguously illustrated by different authors (Fig. 1).

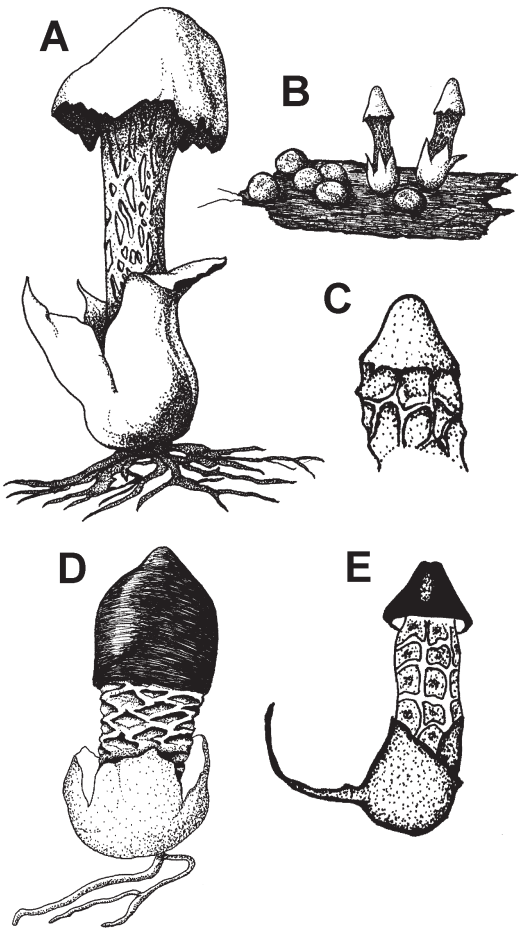

Fig. 1. *Xylophallus xylogenus*, redrawn from original publications: A–B. Montagne (1855), as *Phallus xylogenus*. C. Fischer (1933). D. Sáenz et al. (1972). E. Baseia et al. (2003), as *Phallus pygmaeus*.

Cheype (2010), who recently described and provided colour photos of *X. xylogenus* specimens from the type locality, proposed synonymizing *P. pygmaeus* with *X. xylogenus*.

During field expeditions in the State of Pernambuco, Northeastern Brazil, specimens initially determined as *P. pygmaeus* were collected in abundance

from rotten logs. Our analysis of this material and reexamination of the *P. pygmaeus* holotype leads us to confirm Cheype's (2010) synonymy.

Materials & methods

Field expeditions were carried out in 2008 and 2009 in two reserves in the State of Pernambuco, Northeast Region of Brazil: Reserva Privada do Patrimônio Natural (RPPN) Carnijó (Moreno; 8°10′00″S 35°05′15″W) and Parque Dois Irmãos (Recife; 8°07′30″S 34°52′30″W). Both reserves, at altitudes at 20–180 m, are relict fragments of the Brazilian Atlantic rainforest. The sampled basidiomata were transported to the laboratory in plastic boxes (Lodge et al. 2004). Both fresh and dried basidiomata were examined.

Macroscopic measurements and colors are based on fresh material. Colors are coded according to Kornerup & Wanscher (1978). Observations of microscopic characters were made under a light microscope on glass slides mounts (in 5% KOH) prepared from dried specimens. Voucher specimens are deposited in URM (Thiers 2011).

Taxonomy

Xylophallus xylogenus (Mont.) E. Fisch., Nat. Pflanzenfam., 2 Aufl., 7a: 96. 1933.
Figs 1–3

≡ *Phallus* (*Mutinus*) *xylogenus* Mont., Ann. Sci. Nat., Bot., Sér. 4, 3: 137. 1855.

≡ *Mutinus xylogenus* (Mont). E. Fisch., Nat. Pflanzenfam. 1(1**): 290. 1899.

= *Phallus pygmaeus* Baseia, Mycotaxon 85: 78. 2003.

Basidiomata gregarious; when immature globose, subglobose to ovoid, sometimes tapering towards the base, glabrous, smooth or groovy, 2.5–3.5 mm high × 2.5–4 mm broad, yellowish brown (5D5, 5E5) at the apex, becoming lighter near to the base; at maturity, 6–14 mm high, including the volva. Volva yellowish brown, with irregular dehiscence, basal hyphal strand simple or multiple, whitish, penetrating the woody substrate or forming a network above it. Pseudostipe cylindrical, hollow inside, 5–7 mm high × 1.5–2.5 mm broad, translucent white, indusium absent; externally ornamented by a reticulated structure composed of rectangular alveoles with prominent edges. Receptacle conic-campanulate, surface smooth, adnate to the pseudostipe, with round or umbilicate apex, non or minutely perforate at maturity, 2.5–4 mm high × 2.5–4 mm broad, concolor with pseudostipe; receptacle margin smooth to denticulate. Gleba gelatinous, grayish green (1D5) to olive (1F7), very foetid.

Basidiospores ellipsoid, smooth, thin-walled, hyaline or with greenish tints, 3–4 × 1.5 µm. Volva composed of isodiametric to irregularly rectangular pseudoparenchymatous hyphae, hyaline, yellowish to brownish, slightly thick-walled, 7–15 × 6–13 µm. Pseudostipe and receptacle composed by isodiametric pseudoparenchymatous hyphae, hyaline, thin-walled or slightly thick-walled, 12–45 × 12–32 µm.

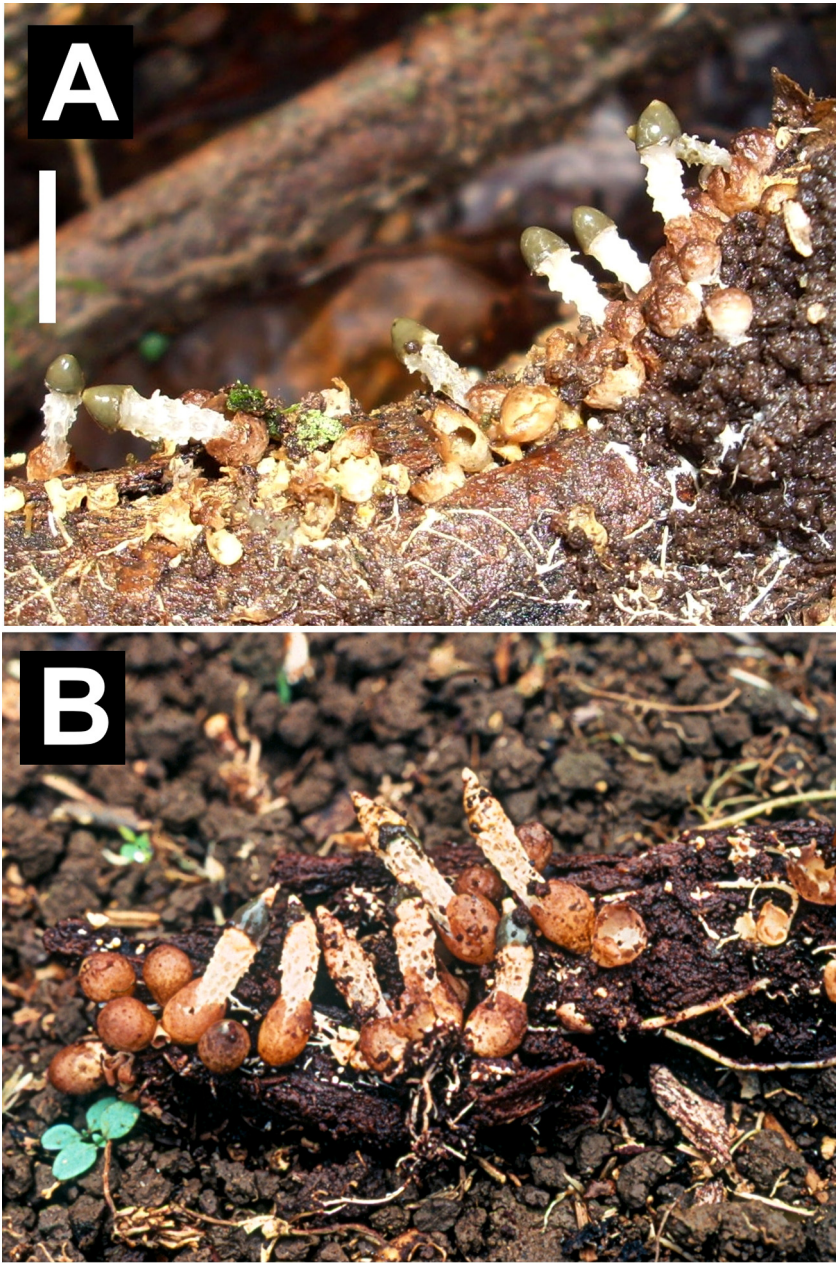

Fig. 2. *Xylophallus xylogenus* in situ.
A. Brazilian basidiomata (scale = 12 mm). B. Costa Rican basidiomata (photo by Clark L. Ovrebo).

Ecology & distribution: on rotten wood in French Guiana (Montagne 1855, Cheype 2010), French Antilles (Guadeloupe; Cheype 2010), Suriname (Fischer 1933b), Costa Rica (Sáenz et al. 1972, Sáenz & Nassar 1982, Calonge et al. 2005), Brazil (as *P. pygmaeus*; Baseia et al. 2003, Baseia et al. 2006, Leite et al. 2007), Peru and Ecuador (Gómez & Gazis 2006).

Specimens examined: **BRAZIL**. **Pernambuco**, Gurjaú, 28.VI.2002, leg. Baseia & Gibertoni (URM 77078, holotype of *Phallus pygmaeus*); Moreno, RPPN Carnijó, 17.VI.2008, leg. Trierveiler-Pereira 10, 11 (URM 80261, 80262); 08.VII.2008, Trierveiler-Pereira 83, 84 (URM 80264, 80265); 14.VIII.2008, Trierveiler-Pereira 186, 187 (URM 80269, 80270); 23.IX.2008, Trierveiler-Pereira 148, 149 (URM 80267, 80268); 16.X.2008, Trierveiler-Pereira (URM 80271); 23.I.2009, Baltazar & Coimbra 206 (URM 80272); 12.III.2009, Trierveiler-Pereira 207, 208 (URM 80273, 80274); 21.V.2009, Trierveiler-Pereira 226, 227 (URM 80275, 80276); Recife, Parque Dois Irmãos, 07.VII.2008, Trierveiler-Pereira 67 (URM 80263); 12.VIII.2008, Trierveiler-Pereira 142 (URM 80266).

Remarks: Desjardin & Perry (2009) noted that *P. xylogenus* was a long forgotten name. Various authors have illustrated it differently (Fig. 1). Montagne's (1855) illustration (Fig. 1B), which is representative, depicts its xylophilous gregarious habit, while Montagne's detailed figure of a single basidiome (Fig. 1A) is quite imaginary, showing the receptacle margin distant from the pseudostipe and the pseudostipe with a shallow reticulum. The illustration in Fischer (1933a), based on original material, is more realistic and the pseudostipe with deep alveoles is well represented (Fig. 1C).

Lloyd's (1907) photo of the original material shows that the upper basidiome of the type was not well preserved, leading him to describe the species as having a "capitate, globose mass of gleba". Dennis (1970) repeated this information, probably based on Lloyd's description. Lloyd's belief that *Xylophallus* was a synonym of *Mutinus* has been wrongly propagated through the literature during the 20th century.

Sáenz et al. (1972) accompany their good detailed description of *X. xylogenus* from Costa Rica with an illustration of the receptacle with an umbilicate apex (Fig. 1D) and perforated apex (approximately 100 μm in diam). Baseia et al. (2003) distinctly illustrated the receptacle pore (Fig. 1E). Among the examined materials, we found specimens with rounded to umbilicate apices, minutely perforated or not. We believe that the perforated apex probably represents the mature receptacle.

Calonge et al. (2005), basing their observations on Dring (1973), cited *X. xylogenus* as cosmopolitan. However, Dring noted distribution only for the entire genus *Mutinus,* not for this species in particular. According to Gómez & Gazis (2006) and elsewhere, although *X. xylogenus* may be common in neotropical forests, the species rarely collected due to its minute size and ephemeral nature.

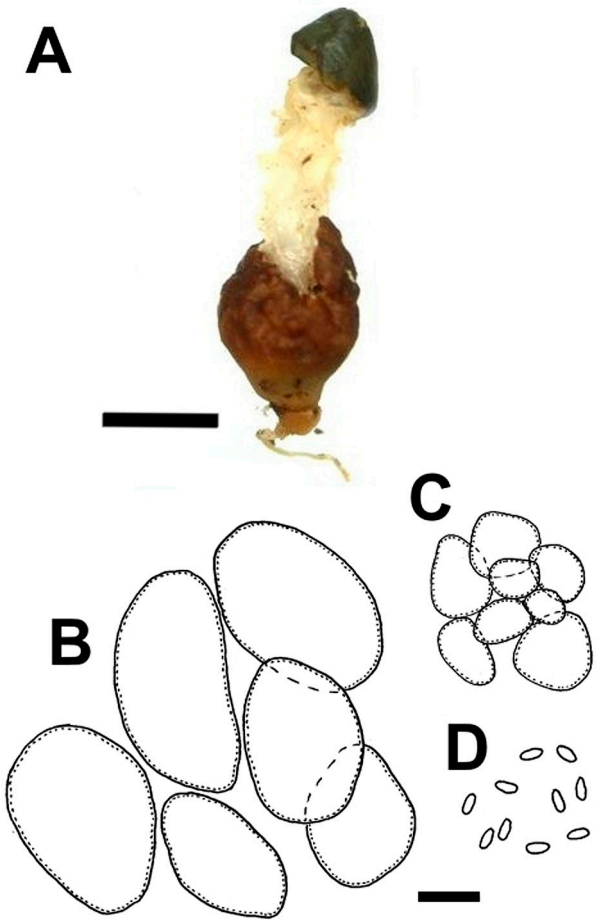

Fig. 3. *Xylophallus xylogenus*.
A. Single basidiome (scale = 2.5 mm). B–D. Microscopical structures (scale = 10 μm):
B. Pseudoparenchymatic hyphae from the pseudostipe.
C. Pseudoparenchymatic hyphae from the volva. D. Basidiospores.

We agree with Sáenz et al. (1972) in separating *X. xylogenus* from *Mutinus*, since the gleba develops on a receptacle externally modified from the pseudostipe. Although the xylophilous habit of *X. xylogenus* is observed in other *Phallus* species, we prefer to retain the species in *Xylophallus* until further molecular analyses are carried out.

Key to small xylophilous phalloid species

1a. Receptacle smooth, minutely perforated; pseudostipe with rectangular alveoles (Neotropics) . . . . . ***Xylophallus xylogenus***

1b. Receptacle reticulate, clearly perforated with a conspicuous pore; pseudostipe minutely reticulate or spongy 2

2a. Pseudostipe yellow, basidiomata 70–100 mm high (China, Japan, Indonesia, Sri Lanka, tropical Africa) . . . . . ***Phallus tenuis***

2b. Pseudostipe white, basidiomata smaller, ≤ 45 mm high 3

3a. Pseudostipe spongy, 25–33 mm high; basidiospores 2–3 µm long (Tanzania, eastern Africa) . . . . . .***P. minusculus***

3b. Pseudostipe reticulate-lacunose, 20–45 mm high; basidiospores 3–3.5(–3.8) µm long (São Tomé, western Africa) . . . . . ***P. drewesii***

Acknowledgments

We thank RPPN Carnijó and Parque Dois Irmãos (Pernambuco, Brazil) for permission to collect; Juliano M. Baltazar and Victor R.M. Coimbra for helping during field work; PPGBF-UFPE and Dra. Leonor Costa Maia, curator of Herbarium URM; CNPq and CAPES (Brazil) for providing fellowship to the first author. We express sincere gratitude to Clark L. Ovrebo (U.S.A.) for his photo and Gabriel Grilli (Argentina) for his assistance in scanning photo slide. We are grateful to Marc Stadler (Germany), Jean-Louis Cheype (France) and Juliano M. Baltazar (Brazil) for suggestions to improve the manuscript; Jacques Fournier (France) for sending useful literature. Dr. Eduardo R. Nouhra (IMBIV, Córdoba, Argentina), María Luciana H. Caffot (IMBIV, Córdoba, Argentina) and Taiga Kasuya (University of Tsukuba, Ibaraki, Japan) are acknowledged for critically reading the manuscript.

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